



Universitat de Lleida

DEGREE CURRICULUM  
**BASICS OF RURAL  
ENGINEERING**

Coordination: MONSERRAT VISCARRI, JOAQUIM

Academic year 2023-24

## Subject's general information

<b>Subject name</b>	BASICS OF RURAL ENGINEERING				
<b>Code</b>	102527				
<b>Semester</b>	2nd Q(SEMESTER) CONTINUED EVALUATION				
<b>Typology</b>	Degree	Course	Character	Modality	
	Bachelor's Degree in Agricultural and Food Engineering	2	COMPULSORY	Attendance-based	
<b>Course number of credits (ECTS)</b>	9				
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRALAB	PRAULA		TEORIA
	<b>Number of credits</b>	0.4	0.6	3.2	4.8
	<b>Number of groups</b>	6	2	1	1
<b>Coordination</b>	MONSERRAT VISCARRI, JOAQUIM				
<b>Department</b>	AGRICULTURAL AND FOREST SCIENCES AND ENGINEERING				
<b>Teaching load distribution between lectures and independent student work</b>	Presential hours: 90 Non-presential hours: 135				
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.				
<b>Language</b>	Catalan: 67% Spanish: 33%				

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
ARNO SATORRA, JAIME	jaume.arno@udl.cat	1,4	
COTS RUBIO, LLUIS	lluis.cots@udl.cat	1,2	
MONSERRAT VISCARRI, JOAQUIM	joaquim.monserrat@udl.cat	5,4	
ROSELL POLO, JOAN RAMON	joanramon.rosell@udl.cat	3,6	

## Subject's extra information

### Subject in the whole curriculum

This subject, located in the second year and the second semester, acts as a bridge between the basic subject Physics and the specific engineering (electrical engineering, machinery and irrigation) of each orientation.

### Requirements to take it

Have studied Physics I, Physics II

### Regulations

Voice and image recording during the course of classes with any medium is strictly prohibited. Mobile phones, digital clocks, tablets and computers will remain switched off until the teacher indicates otherwise to carry out any activity in the classroom that requires it. In the exams, they are totally forbidden.

## Learning objectives

### BLOCK I Hydraulic Engineering

1. Analyze and design simple pipes and canals
2. Analyze pressure networks
3. Know the characteristic curves of the centrifugal pumps. how to select a pump for given conditions.

### BLOCK II Electrical engineering

1. To base the foundations for knowing and using the regulations and electrical equipment that future graduates can find in their professional activity, especially when carrying out an electrification project in the agroforestry field.
2. Acquire the basic knowledge about alternating current and, more specifically, monophasic systems necessary to

solve any electrical system in Engineering.

3. Know the basics of three-phase systems and resolution of symmetrical circuits.
4. Acquire the basics for the electrical calculation of medium and low voltage networks, which are the ones that appear most regularly in the agroforestry field.

## Block III Machine Engineering

1. Know the basic characteristics of the engines that equip the different agricultural machines and know how to select and compare the most important parameters.
2. Know the operation and benefits of air groups (fans).
3. Know the main mechanical transmission systems of the power in the machinery.
4. Know the design bases of different mechanisms and machine elements: clutches, mechanical transmissions with flexible elements, gearboxes and gearboxes and multipliers and gearboxes.
5. Know the basic principles of hydrostatic power transmission systems.
6. Know the bases of design of hydraulic circuits in agricultural machines and the procedures for the selection of components: fluids, pumps, actuators and elements of regulation and control.

In addition, the student must have obtained the CAPACITIES (COMPETENCES) that allow him:

7. Select the basic characteristics of combustion engines, both ignition and compression ignition (diesel).
8. Interpret the characteristic curves of a diesel engine and determine its optimum operating point.
9. Design and select mechanical elements for the transmission of power: friction clutches, torque limiters, gears, belts and transmission chains.
10. Select components for circuits and hydraulic transmissions: pumps, actuators, regulation and control elements and auxiliary elements.

## Competences

### General competences

CG2. Adequate knowledge of physical problems, technologies, machinery and water and energy supply systems, the limits imposed by budgetary factors and construction regulations, and the relationships between facilities or buildings and farms, agri-food industries and areas related to gardening and landscaping with their social and environmental environment, as well as the need to relate those and this environment to human needs and the preservation of the environment.

CG7. Knowledge of basic, scientific and technological subjects that allow continuous learning, as well as an ability to adapt to new situations or changing environments.

CG8. Ability to solve problems with initiative and creative proposals, methodology and using critical reasoning.

CG10. Ability to research and use the rules and regulations relating to their field of action.

### Specific competences

CEFB5. Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields, and waves and electromagnetism and their application for solving problems specific to engineering.

CEMC7. Rural engineering: structure and construction calculation, hydraulics, motors and machines, electrical engineering, technical projects

## Subject contents

Given that this subject presents, in its competitions, a great variation in the different fields of engineering, it is necessary to structure it in three independent blocks, so much so that the matter is studied as with the time it will be taught.

These blocks are:

Block 1 Hydraulic Engineering.

Block 2 Electrical engineering.

Block 3 Machine Engineering.

### **BLOCK I Hydraulic Engineering**

**Unit 1.-** Reminder Properties of liquids and fundamental equations.

**Unit 2.-** Flow in pressure conduits.

- No. of Reynolds. Laminar and turbulent flow in pipes. Limit layer Roughness in pipes.
- Continuous head losses: Darcy-Weisbach formula. Determination of the friction factor:

Moody's abacus; Logarithmic formulas Monomial formulas

- Losses of localized load: losses in sections narrowings, elbows valves. Equivalent length of a conduction.
- Characteristic curve of a pipe. Serial and parallel connection: graphical and numerical method. Examples. Calculation of branched networks.
- Representation of piezometric lines and piezometric lines. Siphon: determination of the flow and maximum height.
- The accumulation of air in the pipes. Depressions and overpressions. Solutions: suction cups, increase diameters, chimneys.

**Unit 3.-** Flow in open conduits: channels.

- Permanent and uniform regime. Types of regime in channels. Forms to determine the head losses: Chezy, Manning, Bazin.
- Pipe comparison - channel

**Unit 4.-** Impulsions.

- Generalities on centrifugal pumps: Parts of a centrifugal pump.
- Characteristic curves of a pump: manometric head-flow, power-flow rate, flow-rate flow and N.P.S.H. Cavitation - Association of pumps in series and in parallel: Graphic method

Numerical Operating point of an installation. Pump selection criteria.

## BLOCK II Electrical engineering

### Unit II.1. Introduction to Electrical Circuits

General concepts. Passive and active components. Resolution of electrical circuits. Kirchhoff's Laws, Knot and Mesh Method. Some electrical circuit theorems.

### Unit II.2. Introduction to alternating current (AC). Single-phase systems.

Generation of alternating voltages. Transient regime and permanent regime. Representations of sinusoidal functions: Cartesian, kinetic, phasorial and complex. Operations with phasors. Complex impedance and generalized Ohm's law. Angular phase shift between voltage and current. Power in alternating current. Power factor, power factor correction. Single-phase circuit problems.

### Unit II.3. Three-phase systems.

Three-phase electromotive force systems, advantages over single-phase systems. Wye (or star or Y) and Delta (or  $\Delta$ ) three-phase systems. Resolution of symmetrical or balanced three-phase circuits. Power in three-phase systems: active, instantaneous, reactive, apparent and complex. Power measurement and power factor correction in three-phase systems. Three-phase circuit problems.

**Unit II.4.** Introduction to the generation, transport and use of electrical energy. Production, transport and distribution of electrical energy. Electrical energy applications: loads.

## Methodology

Content and Activity	RA	Hours	Hours	Hours	Hours	Evaluation
		PA	PL	NP	Tot	
<b>BLOCK I</b>						
Units 1 i 2	1	3	2	8	13	Exercices
Units 3,4,5	3	11	1	20	32	Exercices
Unit 6	2	5	1	10	16	Exercices
Unit 7	3	3	1	7	11	Exercices
Prova 1 Written exam		3				
		25	5	45	75	
<b>BLOCK II</b>						
<b>Unit II.1.</b> Introduction to Electrical Circuits	1	5		8	13	Exercices
<b>Unit II.2.</b> Introduction to alternating current (AC). Single-phase systems	1,2	10		16	26	Exercices

# BASICS OF RURAL ENGINEERING 2023-24

Unit II.3. Three-phase systems	3,4	10		16	26	Exercices
Unit II.4. Introduction to generation, transport and use of electrical energy	1,4	3		5	8	Exercices
Written exam		2			2	
		30		45	75	
<b>BLOCK III</b>						
Unit 1 Màquines de fluid tèrmiques i turbomàquines	1-2	12	2	23	37	Exercices
Prova 1 Written exam unit 1	7-8	1			1	
Unit 2 Mecanismes i disseny d'elements de màquines	3,4,9	5	2	11	18	Exercices
Unit 3 Oleohidràulica agrícola	5,6,10	5	11		16	Exercices
Prova 2 Written examt Units 2 i 3		1	2		3	
		24	6	45	75	
Total		79	11	45	225	

## Observations

Tutoring will be on-demand and face-to-face.

## Development plan

Setmana	Setmana	Hores Grup Gran	Practiques			Hores totals
			Total GGran	nº Grups	GPetit	
1	07/02/2022	6				Electricitat JR Rosell
2	14/02/2022	6		2	2	
3	21/02/2022	4		2	2	
4	28/02/2022	4		2	2	6
5	07/03/2022	4	24			30
6	14/03/2022	4		6	2	Motors J Arnó
7	21/03/2022	4				
8	29/03/2022	4				1 Av Ex Electricitat
9	04/04/2022	6				OleoHidraulica

10	11/04/2022	S Santa				
11	18/04/2022	4				
12	25/04/2022	4				28
13	02/05/2022	4				Hidraulica
14	09/05/2022	6				Examen E.MAquines
15	16/05/2022	6	6	2		
16	23/05/2022	6	30			
17	30/05/2022	8				32

## Evaluation

### Block I Electrotechnics (Electrical Engineering). Weight of this Block: 33.33%

The evaluation of this block will consist of three activities:

**Activity I.1:** completion, by the student, of a written test. **Weight of this activity: 30% (90% of Block I).** The written test (examination) will consist of a set of questions (which may consist of problems, questions, etc.) where the knowledge and skills acquired throughout the development of the subject block will be evaluated. The examinable syllabus will include the concepts explained in the theoretical sessions and in the problem solving sessions. To pass this block **it is necessary that the Block I Grade is  $\geq 5$  and, in addition, obtain a grade  $\geq 4.45$  in the exam (out of 10) in activity I.1 (written test)**, which, weighted (at 90%) **equals 4 points**. So, **Activity I.1 Grade =  $0.9 * \text{Exam grade (out of 10)}$** . In other words, within Block I Electrotechnics, the maximum mark for this activity is: **Maximum mark for Activity I.1 = 9 points**.

**Activity I.2:** completion, by the student, of exercises/problems/reports set by the teacher. **Weight of this activity: 2,33% (7% of Block I).** In other words, within Block I Electrotechnics, the maximum mark for this activity is: **Maximum mark for Activity I.2 = 0.7 points**.

**Activity I.3:** attendance (face-to-face) in classes equal to or greater than 80%. **Weight of this activity: 1% (3% of Block I).** Non-attendance for justified reasons will be taken into account. In other words, within Block I Electrotechnics, if this activity is passed, **Mark for Activity I.3 = 0.3 points**.

To pass this block **it is necessary that the Block I Grade is  $\geq 5$  and, in addition, obtain a grade  $\geq 4.45$  in the exam (out of 10) in activity I.1 (written test)**, which, weighted (at 90%) **equals 4 points**

Therefore: **Mark for Block I Electrotechnics = Mark for Activity I.1 (if  $\geq 4$ ) + Mark for Activity I.2 + Mark for Activity I.3**

## Bibliography

### Basic bibliography

#### Block I

GILES, R.V. 2001. **Mecánica de fluidos e hidráulica. Problemas resueltos**. Mc Graw Hill

ARVIZA, J. 2016. **Problemas de hidráulica**. Univ. Politec. Valencia.

STREETER, V. **Mecánica de fluidos**. Mc Graw Hill

BARRAGÁN, J.; MONSERRAT, J. (2004) - **Algunas notas para Hidráulica y Riegos**- ETSEAgraria-Lleida



## Block II

ROSELL, J.R. 2022. **Circuits elèctrics monofàsics i trifàsics. Fonaments teòrics i exercicis resolts**. Unedited teaching material.

ROSELL, J.R. 2000. **Circuitos eléctricos monofásicos y trifásicos**. Edicions de la Universitat de Lleida

## Block III

AGÜERA, J. 1999. **“Termodinámica lógica y motores térmicos”**. 6ª edición mejorada. Madrid: Editorial Ciencia 3, S. A.

GIL, J. 1998. **“Elementos hidráulicos en los tractores y máquinas agrícolas”**. 2ª edición, revisada y ampliada. Madrid, Ediciones Mundi-Prensa, 256 pp.

## Complementary bibliography

### Block I

AGÜERA, J. 1996. **Mecánica de los fluidos incompresibles y turbomaquinas hidráulicas**. Ed. Ciencia 3

LAZARO LOPEZ, A. 1997. **Manual de hidráulica**. Universidad de Alicante

CABRERA, E. y d'altres (1996). **Ingeniería hidráulica aplicada a los sistemas de distribución de agua. Vol. I**. Universitat Politècnica de Valencia.

CHOW, V.T. 1994. **Hidraulica de los canales abiertos**. Ed. Mc Graw Hill.

### Block II

GARCIA, J. 2004 **“Instalaciones eléctricas en media y baja tensión”** Ed. Thomson – Paraninfo – (2004)

GARCÍA TRASANCOS, J. 2006. **Electrotecnia**. 9ª ed. Madrid: Thomson-Paraninfo.

LUNA SANCHEZ, L. *et al.* 2008. **Instalaciones eléctricas de baja tensión en el sector agrario y agroalimentario**. Madrid: Ediciones Mundi-Prensa.

### Block III

BOTO, J.A. 2000. **“La mecanización agraria”**. Universidad de León.